Astroculture™: Working to Plant the Future

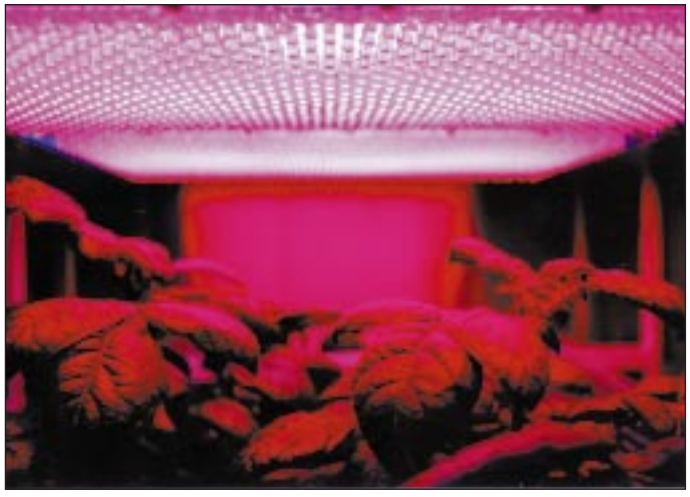
Research with plants in microgravity offers many exciting opportunities to gain new insights, and could improve products on Earth ranging from crop production to fragrances and food flavorings. The ASTROCULTURE™ facility is a lead commercial facility for plant growth and plant research in microgravity, and was developed by the Wisconsin Center for Space Automation and Robotics

ASTROCULTURE™ has been used successfully on several shuttle missions for a variety of research.

(WCSAR), a NASA Commercial Space Center. On STS-95 it will support research that could help improve crop development, leading to plants that are more disease resistant or have a higher yield, and provide data on the production of plant essential oils — oils that contain the essence of the plant and provide both fragrance and flavoring.

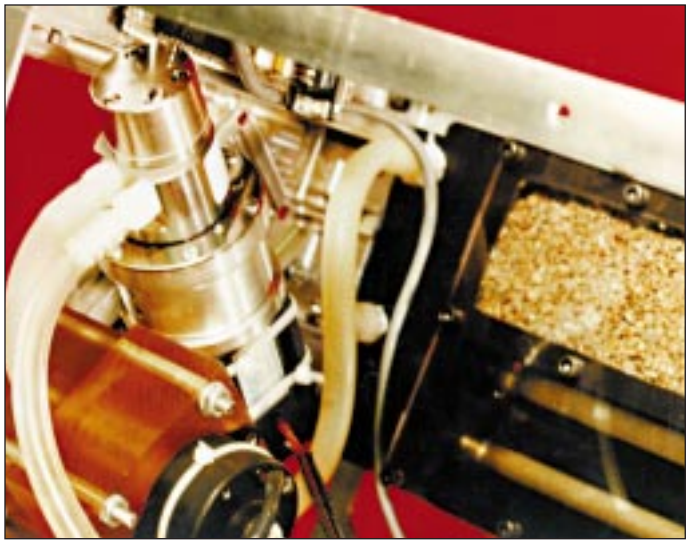
The development of new plants having a particular desired trait can be a long and frustrating process. Instead of older methods that can take years to obtain results, researchers now use bacteria to transfer the gene carrying the desired trait to seedlings, which will then pass that trait along to future generations of the plant. In Earth-based laboratories, however, the expected success rate for this process is at best 1 plant in 1,000, or 0.1 percent. Microgravity, however, may offer the opportunity to improve this rate. To get the needed data, industry partners Rapigen, LLC, The Indiana Crop Improvement Association, Inc., Christophersen & Associates, Inc., and the University of Toledo have joined with WCSAR to explore this opportunity.

To do this, approximately 1,000 soybean seedlings will be wrapped in water-soaked paper rolls and flown in a modified locker. The seedlings will have their growing point (meristem) region damaged just before launch, which will provide the bacteria an entry point to the seedlings. Once in orbit, the bacteria will be mixed with a growth medium and channeled into the container with the paper rolls. After the mission, the seedlings will be planted and examined to determine how many picked up the desired trait.



High-output light-emitting diodes (LEDs) illuminate these potato plants being grown as part of development efforts.

Fragrant oils are an important part of modern life. They are used in perfumes and cosmetics, personal care items, cleaning products, and in food flavorings. The second investigation supported by ASTROCULTURE™ will examine the possible effects of microgravity on the production of essential oils from plants. Previous research has shown that plant processes are altered in microgravity, raising the potential for altered production of essential oils, some of which may not be produced in any significant amount on Earth. On STS-95, a flowering plant will be



Courtesy: WCSAR

The Astroculture™ payload uses porous tubes with precise pressure sensing and control for fluid delivery to the plant root tray.

grown in ASTROCULTURE™, and samples taken using a method developed by the industry partner for this investigation. On Earth, the samples will be analyzed by gas chromatography/mass spectrometry, and the data used to evaluate both the production of fragrant oils in microgravity and in the development of one or more products.

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